Welcome

Angela Darlington

CEO of UK Insurance, Aviva
Key Note

Sarah Breeden
Executive Director, International Banks Supervision
Prudential Regulation Authority
Bank of England

#TCFDRecs
Key Note: ‘The Global Impacts and Risks of Climate Change’

Christopher Hope
Emeritus Reader in Policy Modelling
University of Cambridge
A sense of urgency about climate change

Source: https://www.desmog.co.uk/2019/05/01/climate-emergency-extinction-rebellion-language-urgency-parliament-labour-motion-ccc-net-zero
Present commitments

Source: 100,000 runs of the PAGE-ICE model
Climate impacts under present commitments

Source: 100,000 runs of the PAGE-ICE model

Mean NPV to 2300 of about $1400 trillion

NPV of global residual impacts

Mean 1.413E+009
Median 1.030E+009
Std Dev 1.328E+009
10% 421,606,130.56
25% 638,548,519.33
75% 1.701E+009
90% 2.770E+009
Values 100000

$ thousand trillion
Climate policy implications of nonlinear decline of Arctic land permafrost and other cryosphere elements

Dmitry Yumashev, Chris Hope, Kevin Schaefer, Kathrin Riemann-Campe, Fernando Iglesias-Suarez, Elchin Jafarov, Eleanor J. Burke, Paul J. Young, Yasin Elshorbany & Gail Whiteman

Nature Communications 10, Article number: 1900 (2019) | Download Citation
Climate change tax to internalise the impacts under present commitments

Source: 100,000 runs of the PAGE-ICE model
What does a climate change tax of $310 per tonne of CO₂ imply?

• 50 pence on a litre of petrol
  Typical retail price 130 p/litre

• 4 p/kwh on gas
  Typical retail price 5 p/kwh

• 15 p/kwh on electricity from coal

• 6 p/kwh on electricity from gas
  Typical retail price 15 p/kwh

• £150 on a return air ticket from London to Barcelona
  Typical retail price ???
UK Revenue from a climate change tax of $310 per tonne of CO₂

• From CO₂ £ 90 billion
• UK share of International Air Travel: £ 10 billion
• Other greenhouse gases: £ 15 billion
• Potential revenue in first year: £ 115 billion

• Revenue in 2030: £ 105 billion
  (Tax rate increases by 30%, emissions reduce by 30%)

• Total UK tax revenues £ 500 billion

Source: Author’s calculations
Potential uses of £115 billion per year climate change tax revenue

Fiscal neutrality is important for public acceptance

• Reduce basic rate income tax from 20% to 10%  £ 40 billion
• Reduce VAT from 20% to 12%  £ 40 billion
• Protect poor and elderly from energy price increases  £ 20 billion
• Support R&D, information campaigns etc  £ 15 billion
Cutting emissions to have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100
Abatement costs to have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100

Source: 100,000 runs of the PAGE-ICE model
Climate impacts under policies that have a 50% chance of keeping the rise in global mean temperature below 2 degC in 2100

Mean NPV to 2300 of about $465 trillion

Mean drop in impacts is over 5 times the mean abatement costs

Source: 100,000 runs of the PAGE-ICE model
c.hope@jbs.cam.ac.uk
@cwhope
The ‘Changing Course’ Report
The ‘Changing Course’ Report
The ‘Changing Course’ Report

1. A comprehensive mapping
2. Step-by-step detail on the piloted methodology
3. Real investor experiences
The ‘Changing Course’ Report

From Risk Assessment to Aligning Portfolios
Changing Course Report Highlights

Jason Eis
Executive Director, Vivid Economics

#TCFDRecs
Forward looking scenario-based assessments of climate related risks and opportunities are core to the TCFD recommendations

Why scenario analysis?

The timing, magnitude and nature of climate change impacts on companies’ business models, strategies and financial performance is uncertain – to appropriately incorporate these potential impacts in strategic decisions investors need analyse the potential risks and opportunities under various possible states of the world, exploring a wide variety of sensitivities.
There are a large number of scenario analysis methodologies and providers that offer diverse and continually improving analyses

- We reviewed **methodologies from publicly published examples** of scenario analysis for investors

- The review found **a vibrant market of service providers** to support TCFD-compliant scenario analysis – this included 14 different providers, and that list is not necessarily exhaustive

- **Many providers share common core methodological elements**, drawing on similar datasets, modelling components and methods for financial valuation

- **However, significant diversity exists, with providers offering different (and sometimes complementary) methodologies** for assessing climate-related financial risks and opportunities across various asset classes, scenarios and output formats

- As a result, there is already a large set of methodologies to choose from, depending on desired scope, depth and focus of analysis.
Analytical elements of scenario-based impact assessments
Framework for analysis of TRANSITION approaches

<table>
<thead>
<tr>
<th>Macro environment</th>
<th>Exposure</th>
<th>Sensitivity</th>
<th>Adaptive capacity</th>
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<tbody>
<tr>
<td></td>
<td>Economic diversification, political climate</td>
<td>Dependence on emissions-intensive sectors</td>
<td>Fiscal and monetary and political flexibility, development level</td>
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<tr>
<th>Supply chain</th>
<th>Location (carbon pricing) of suppliers</th>
<th>Supplier emissions intensity and ability to pass through costs</th>
<th>Producer capacity to shift to low-carbon suppliers or inputs</th>
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<tr>
<th>Operations and assets</th>
<th>Location (carbon pricing) of facilities</th>
<th>Producer emissions intensity</th>
<th>Producer abatement potential</th>
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<tr>
<th>Market</th>
<th>Location (carbon pricing) of sales</th>
<th>Preference shifts, price reaction, consumption emissions intensity</th>
<th>Producer capacity to shift customer base or pass through cost</th>
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Framework for analysis of PHYSICAL approaches

<table>
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<tr>
<th>Scope of assessment</th>
<th>Exposure</th>
<th>Sensitivity</th>
<th>Adaptive capacity</th>
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<tr>
<td>Macro environment</td>
<td>Economic diversification, location</td>
<td>Economic dependence on climate-exposed sectors</td>
<td>Fiscal and monetary flexibility, development level</td>
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<td>Supply chain</td>
<td>Location of suppliers</td>
<td>Supplier natural resource intensity and shock resilience</td>
<td>Producer capacity to shift supply chains</td>
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<td>Operations and assets</td>
<td>Location of facilities</td>
<td>Sectoral/facility type resource and capital intensity</td>
<td>Resilience of individual facilities</td>
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<tr>
<td>Market</td>
<td>Location of sales</td>
<td>Market sensitivity to weather events and price shocks</td>
<td>Producer capacity to shift customer base or pass through cost</td>
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## Physical risk impact assessment

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<thead>
<tr>
<th>Provider</th>
<th>Scenarios</th>
<th>Risks</th>
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Where gaps remain (a.k.a. what are the emerging advances)?

Scope of methodologies

• Currently do not cover the entire value chain of counterparties from suppliers to markets
• Currently don’t extend across the range of asset classes with a consistent level of bottom-up detail
• Do not include risks such as legal and reputational risk

Depth of methodologies

• Remain inadequate in their examination of ‘adaptive capacity’, and hence don’t fully account for dynamic responses to climate risks and opportunities
• For physical risk in particular, methodologies do not sufficiently consider the opportunities created

Integration of methodologies

• Do not integrate macroeconomic (top-down) and microeconomic (bottom-up) analysis in a consistent, holistic way
• Rarely consider physical and transition risk together, and the potential trade-offs that arise

There is a clear need for better disclosure of climate-related data from investee companies, particularly including a company’s individual sensitivity and adaptive capacity. The more granular the data disclosed by investee companies, the more informative scenario-based analysis can be for investors. This includes data on individual facilities, such as production sites and real estate.
Caveat emptor

- While scenario analysis can be a useful tool to explore and disclose the potential impacts of an uncertain future, it is not a precise prediction of the future.

- The purpose of scenario analysis is to explore several plausible ‘what-if’ scenarios, rather than to precisely forecast the future or to evaluate the correctness of current market pricing.

- There are some critical underlying complexities in the relationships between, for example:
  - Atmospheric GHG concentrations and the climate system
  - The climate system and the economy
  - Emissions reduction policies, technological innovation and market behaviours

- This means that any numbers derived from such methodologies should be used with caution and fully evaluated in the context of the scenario’s and model’s underlying assumptions.
Pilot Project Methodology

David Lunsford
Co-Founder, Carbon Delta

#TCFDRecs
Thank you UNEPFI and Investor Group!
Impact of Climate Change on Company’s Profitability

Russia – heat wave 2010
• **Carlsberg**: 13% loss in quarterly profits reported by in Q2 2011

California – wildfires 2018
• **PG&E (Californian utility)**: filed for bankruptcy due to hundreds of lawsuits from victims of fire

California – Clean Energy and Pollution Act – 50% Renewables by 2030
• **Sunrun**: 1000% revenue growth
• **Vivint Solar**: 4000% revenue growth

India – 100% electric vehicles by 2030
• **Tata Motors**: 5% in electric vehicle development, Net Income is forecast to accelerate by 35% for 2020/2021

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A Hybrid Approach is Necessary Due to Data Limitations
The Carbon Delta Modelling Process

- Impact Modelling
- Cost / Profit Calculations
- Security Valuation
- Portfolio Level
UNEPFI Project Components

- Methodologies
- Financial Modelling
- Real Estate
- Online Tool
Climate Change Analysis Pillars

**Transition Risks & Opportunities**

- **Policy**
  - 15 years +
  - ✓ 1.5°C-Scenario
  - ✓ 2°C-Scenario
  - ✓ 3°C-Scenario / NDC

- **Technology**
  - 15 years +
  - ✓ 1.5°C-Scenario
  - ✓ 2°C-Scenario
  - ✓ 3°C-Scenario / NDC

**Physical Risks & Opportunities**

- **Physical**
  - 15 years +
  - ✓ Average RCP 8.5

= Climate VaR
Climate Change Analysis Pillars

**Transition Risks & Opportunities**

- **Policy**
  - 15 years+
  - 1.5°C-Scenario
  - 2°C-Scenario
  - 3°C-Scenario / NDC
  - 6 x 2°C Scenario

- **Technology**
  - 15 years+
  - 1.5°C-Scenario
  - 2°C-Scenario
  - 3°C-Scenario / NDC
  - 6 x 2°C Scenario

**Physical Risks & Opportunities**

- **Physical**
  - 15 years+
  - Average RCP 8.5
  - Worst Case RCP 8.5

= **Climate VaR**

- Average RCP 8.5

**Physical Risks & Opportunities**

- Physical VaR

**Transition Risks & Opportunities**

- Transition VaR

**Climate Change Analysis Pillars**

- Climate VaR

**RCP 8.5**

- Wors case

**FIRE**

- FDIC...

**RCP 8.5**

- Wors case

**FIRE**

- FDIC...
Climate VaR – Transition Risks

The Methodology
Methodology – Transition Risks

- Sectors
- Facilities

[Diagram showing the connection between sectors and facilities]
Shared Socioeconomic Pathways (SSPs)

2°C Scenario CO₂ Emissions
2°C Scenario CO₂ Emissions

**GCAM4**
Joint Global Change Research Institute Pacific Northwest National Laboratory & University of Maryland

**IMAGE**
PBL Netherlands Environmental Assessment Agency
2°C Scenario Global Temperature Change
2°C Scenario Global Temperature Change
Climate VaR – Technology Opportunities

The Methodology
Low carbon patent examples (1)

**Composite Binders at Heidelberg**

- Alternative binder in the cement production
- Reduces the CO$_2$ footprint of cement production


**Smart Grids at Siemens**

- Improves the electricity network
- Saves overall energy and makes the society more efficient

Patent: 20140912WO2014137655A1, DEMAND SHAPING IN AN ELECTRICAL POWER GRID
Low carbon patent examples (2)

Nuclear Fusion at Lockheed Martin

• Small and compact nuclear fusion reactors
• Ready for market in 5-10Y.

Patent: 20141009CA2908480A1, MAGNETIC FIELD PLASMA CONFINEMENT FOR COMPACT FUSION REACTOR

Biotechnology at Novartis

• Improves the production of chemicals
• Saves general amounts of used materials, heat with biocatalysis.

Patent: 20150115CA2916905A1, MULTIPLE PROTEASES DEFICIENT FILAMENTOUS FUNGAL CELLS AND METHODS OF USE THEREOF
Methodology – Transition Opportunities

- High-quality, High-potential Low Carbon Patents
- Future Green Revenues
- Future Green Profits
- Scenario-specific Climate Change Opportunities
Climate VaR – Physical Risks

*The Methodology*
Methodology – Physical Climate Risks & Opportunities

**Expected Cost** = **Vulnerability** × **Hazard** × **Exposure**

- **Vulnerability**
  - Cost Function

- **Hazard**
  - Extreme Weather

- **Exposure**
  - Company Facility
Extreme Weather Hazards in the Model

- Extreme Heat *(Re-Analysis)*
- Extreme Cold *(Re-Analysis)*
- Heavy Precipitation *(Re-Analysis)*
- Heavy Snowfall *(Re-Analysis)*
- Wind Gusts *(Re-Analysis)*
- Coastal Flooding *(Climate Models)*
- Tropical Cyclones *(Probabilistic Model - Climada)*
<table>
<thead>
<tr>
<th>Climate Scenario Data Use Cases</th>
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<tr>
<td><strong>Strategic &amp; Tactical Asset Allocation</strong></td>
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<tr>
<td><strong>Risk Management</strong></td>
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<tr>
<td><strong>Security Selection</strong></td>
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<td><strong>Regulatory Reporting</strong></td>
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</tbody>
</table>

- **Warming Potential for Fund Creation**
- **Sectoral & regional over- and underweights**
- **Green Technology Opportunities for Alpha Creation**
- **Downside Risk Reduction**
- **CSR and TCFD reporting**
- **Shareholder engagement**
Changing Course

Coffee Break
Next Session: 15:00

10th May
Aviva Head Office
London
Tool Demonstration

Anja Ludzuweit

Director of Business Development, Carbon Delta

#TCFDRecs
High-Level Panel

Margaret Kuhlow, Climate Practice Lead, WWF
Sasja Beslik, Nordea Group Head of Sustainability
Steve Waygood, Chief Responsible Investment Officer, Aviva
Willemijn Verdegaal, Co-Head Climate & ESG Solutions, Ortec Finance

Moderator: Elodie Feller, UNEP FI

#TCFDRecs
Closing Intervention

Ed Baker

Senior Policy Officer, PRI

#TCFDRecs
Thank you
Changing Course

For your copy, visit: www.unepfi.org/investment/tcfd

10th May
Aviva Head Office
London